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The Addition of the Hormone Thyroxine (T4) to the feed to Accelarate the Growth of Bronze Featherback (*Notopterus notopterus*, Pallas 1769)

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Abstract*— *Bronze featherback (Notopterus notopterus, Pallas 1769) are freshwater fish whose population in nature has decreased. This population decline is due to fishing activities carried out by local fishermen in the wild that do not consider the size of the fish. As a result, fish that are small and not consumed are also caught. Also often found caught fish that are in the spawning season. Efforts that need to be done to prevent the extinction of these fish in nature are by cultivating fish. One of the weaknesses in current Bronze featherback farming is the slow growth of the fish being kept. To accelerate the growth of fish in this maintenance, it is necessary to try the addition of the hormone thyroxin in the feed given to fish. This research was conducted in Sungai Paku Village, Kampar Kiri District, Kampar Regency, and Riau Province from July to August 2020. The design used in this study was a completely randomized design (CRD) with one treatment and three replications. The treatment used in this study was the addition of thyroxin hormone at different doses given to feed (trash fish) consisting of P1 (0 mg thyroxin/kg feed), P2 (2 mg thyroxin/kg feed), P3 (4 mg thyroxin/kg feed) and P4 (6 mg thyroxin/kg feed). The results showed that the best treatment of thyroxin hormone was 6 mg/kg feed with an absolute weight growth value of 59.96 g, an absolute length growth of 14.3 cm, a specific growth rate of 3%, and a survival rate of 95%.

Keywords*— *Absolute weight, absolute length, daily weight growth rate, life span, and thyroxin.

I. INTRODUCTION

Bronze featherback (*Notopterus notopterus*, Pallas 1769) is a type of freshwater fish whose population in nature has decreased. This fish is one of Indonesia's endemic fish that has high economic value (Yulindra et al., 2017; Sukendi et al., 2020). According to Sunarno (2002), high-fat content makes Bronze featherback taste delicious and distinctive. Bronze featherback, apart from being used as consumption fish, can also be used as ornamental fish. The community's demand for this fish is getting higher, while to meet the needs of the community it is still obtained solely from catches in public waters. This causes Bronze featherbacking activity in nature to be so high (Yulindra et. al., 2017).

Fish farming activities are the right solution to be applied to reduce the decline in fish populations from nature and still provide food fish for the community (Anderson et al., 2011 and Benkendorff, 2009). However, in the Bronze featherback culture, the weakness that was found was the slow growth that occurred during maintenance. To accelerate the growth of these fish, it is necessary to try the addition of the hormone thyroxin (T4) in the feed given to domestic fish.

The thyroxin hormone (T4) is a hormone produced by the thyroid gland in addition to the thriyodotironin (T3) hormone which functions in general metabolism and growth (Hoar and Randall, 1969). The function of T4 / T3 has been proven in some freshwater fish that T4 and T3 can stimulate growth, development, and absorption of eggs in the larval period (Lam, 1994). The use of the thyroxin hormone to stimulate fish growth has been carried out in several fish including coral platypus fish (*Xiphophorus maculatus*) (Zairin *et al.*, 2005), goldfish (*Carrasius auratus*) (Sembiring *et al*., 2015), pond fish (*Hellostoma temmincki* CV) (Defrian, 1998), baung fish (*Mystus*

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nemurus CV) (Isvarida, 2004), monitor fish (*Rasbora lateristriata* Blkr) (Legimin, 2005), motan fish (*Thynnicthys thynnoides* Blkr) (Sukendi, Putra and Yurisman., 2011) and pawas (*Osteochilus hasselti* CV) (Sukendi, Thamrin and Putra, 206).

II. METHOD

This research was conducted in Sungai Paku Village, Kampar Kiri Sub district, Kampar Regency, Riau Province from July to August 2020. The bronze featherback used comes from the catch of fishermen in the Kampar River with a size of 8-10 cm. Fish are reared in cages (size 1x1x1 m3) which are installed in the ground pond. Fish are fed 3 times a day (morning, afternoon, and evening) at a dose of 5% per weight of biomass. Fish weight and length were measured every 10 days. The fish length was measured using graph paper and fish weight was measured using a Shimadzu ELB600 type analytic chart. To obtain growth data, maintenance was carried out for 90 days. While the research design used, there was a completely randomized design with one treatment, 4 levels of doses (P1, P2, P3, and P4), and three replications. The treatments used were thyroxin hormone, and the dosage levels used consisted of P1 (0 mg thyroxin/kg feed), P2 (2 mg thyroxin/kg feed), P3 (4 mg thyroxin/kg feed), and P4 (6 mg thyroxin/kg of feed). The feed used during rearing is finely chopped trash fish.

The variables measured in this study were the growth in absolute weight determined using the formula: Absolute weight growth = fish weight at the end of the study - fish weight at the beginning of the study, absolute length growth = fish length at the end of the study - fish length at the beginning of the study, Daily Growth Rate (SGR) = Ln fish weight at the end of the study - Ln fish weight at the beginning of the study/time x 100% and survival = number of fish at the end of the study/number of fish at the beginning of study x 100%. Water quality data in the form of temperature, pH, and dissolved oxygen (DO) were obtained by measuring once a week in the morning, afternoon, and evening. Measurement of temperature has using, a thermometer, pH measurement using a pH meter, and DO measurements using a DO meter.

The data on the growth and survival of the fish obtained were tabulated and statistical tests were performed using the SPSS 16 application. The statistical tests used the homogeneity of variances and one-way analysis of variance (ANOVA) tests. If the ANOVA test results showed a significant difference ($P < 0.05$) then a further test was carried out using the SNK test to determine the differences between treatments. The water quality data obtained were tabulated and described.

III. INDENTATIONS AND EQUATIONS

Based on research that has been carried out by raising bronze featherback for 90 days, data on the growth and survival of bronze featherback were obtained. Data on the growth and survival of Bronze featherback were measured as a representation of the effect of the thyroxin hormone treatment that had been given.

3.1. Absolute Weight Growth

The growth in absolute weight of bronze featherback maintained for 90 days of rearing by feeding trash fish added with thyroxin hormone is shown in Figure 1. The highest growth of bronze featherback absolute weight was obtained in sequence at the treatment dose of 6 mg/kg of feed with a value of 59.96 g, followed by treatment with a dose of 4 mg/kg of feed with a value of 57 g, treatment with a dose of 2 mg/kg of feed with a value of 51.22 g, and treatment without the thyroxin hormone with a value of 46.97 g. Based on the results of statistical tests using the analysis of variance (ANOVA) test, it is known that the treatment given had a very significant effect ($P < 0.01$) on the absolute length growth of bronze featherback. The results of further tests using the Student Newman Keuls (SNK) test showed that the absolute weight growth of bronze featherback without thyroxin hormone was significantly different ($P < 0.05$) from bronze featherback that were given the hormone thyroxin 2 mg/kg feed and was very significantly different ($P < 0.01$) with Bronze featherback that were given the thyroxin hormone dose of 4 mg and 6 mg/kg of feed.

The highest absolute weight growth value of bronze featherback *Notopterus notopterus* fish obtained during 90 days of maintenance reached 59.96 g. The high absolute weight growth value of bronze featherback obtained in the treatment of the highest dose of thyroxin hormone (6 mg/kg of feed) is due to the function of the thyroxin hormone, namely in general metabolism and growth and reproduction (Hoar *et al*., 1969; Nacario, 1983, Power et al., 2001 and Heraedi *et al*., 2018). The thyroxin hormone is a hormone produced by the thyroid gland. The thyroid gland functions to form, store, and secrete substances related to the regulation of the metabolic rate (Muslim et. al.,, 2019). This increase in metabolic rate is influenced by the increase in oxygen consumption by fish (Dewi, 2006). Besides, the thyroxin hormone can increase protease and lipase activity in the digestive tract so that it can increase protein and fat metabolism in the body (Zairin *et al*., 2005). The factors that influence the activity of the

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thyroxin hormone are dose, method of hormone administration, food quality, feeding time, and fish size (Tripathi & Verma, 2003; Pebriyanti et al., 2015).

The best dose of thyroxin hormone obtained from this study is the same as the results of research conducted by Sukendi et al., (2011) which stated that feeding mixed with the hormone thyroxin 6 mg/kg of feed resulted in the growth of the absolute weight of motan fish (*Thynnichthys thynnoides* Blkr) the highest with a value of 9.23 grams for maintenance in cages in rivers and 9.13 grams for maintenance in ponds. Whereas for pearl Sepat fish (*Trichogaster leeri* Blkr), feeding mixed with thyroxin hormone at a dose of 6 mg/kg of feed resulted in the highest absolute weight growth of 7.187 grams. Sukendi *et al*., (2013).

3.2. Absolute Length Growth

The absolute length growth of bronze featherback maintained for 90 days by feeding trash fish added with the thyroxin hormone is presented in Figure 2. The highest growth in absolute length of bronze featherback sequentially was obtained at the treatment dose of 6 mg/kg of feed with a value of 14.3 cm, followed by treatment. a dose of 4 mg/kg of feed with a value of 14 cm, a treatment dose of 2 mg/kg of feed with a value of 13 cm, and treatment without the hormone thyroxin with a value of 12.5 cm. Based on the results of statistical tests using the analysis of variance (ANOVA) test, it is known that the treatment given had a very significant effect (P <0.01) on the absolute length growth of bronze featherback. The results of further tests using the Student Newman Keuls (SNK) test showed that the absolute length growth of bronze featherback without thyroxin hormone was significantly different (P <0.05) from bronze featherback given the thyroxin 2 mg/kg feed hormone and was very significantly different (P < 0.01) with bronze featherback given the thyroxin hormone dose of 4 mg and 6 mg/kg of feed.

The high value of the absolute length growth of bronze featherback obtained at the treatment dose of 6 mg/kg of feed was in line with the growth in the highest absolute weight of bronze featherback which was also obtained at the treatment dose of 6 mg/kg of feed. The growth of bronze featherback that is given the thyroxin hormone is influenced by the increase in fish metabolism by the thyroxin hormone. Guyton (1983) states that the main effect of the thyroxin hormone is to increase the metabolic activity of somebody tissues so that the speed of using food for energy is greatly accelerated. Sudrajat et al., (2013) stated that giving the hormone thyroxin to Siamese catfish can increase the length growth of these fish. The absolute length growth value of Bronze featherback obtained at the treatment dose of 6 mg/kg of feed was lower than the absolute length growth value of *Notopterus chitala* fish that were kept in polyculture with tilapia for 6 months, namely 16.5 cm (Samad et.al., 2017).

3.3. Spesific Growth Rate (SGR)

The growth rate of the daily weight of bronze featherback maintained for 90 days by feeding trash fish added with thyroxin hormone is presented in Figure 3. In Figure 3, it can be seen that the highest growth rate of bronze featherback daily weight is obtained in sequence at the treatment dose of 6 mg/kg of feed with a value 3%, followed by treatment with a dose of 4 mg/kg of feed with a value of 2.9%, treatment with a dose of 2 mg/kg of feed with a value of 2.8%, and treatment without the thyroxin hormone with a value of 2.7%. Based on the results of statistical tests using the analysis of variance (ANOVA) test, it is known that the treatment given had a very significant effect (P <0.01) on the growth rate of the daily weight of bronze featherback. The results of further tests using the Student Newman Keuls (SNK) test showed that the daily growth rate of bronze featherback without thyroxin hormone administration was significantly different (P <0.05) from Bronze featherback given the thyroxin 2 mg/kg feed hormone and was very significantly different (P <0.05). <0.01) with bronze featherback that were given the thyroxin hormone dose of 4 mg and 6 mg/kg of feed.

The value of the highest daily weight growth rate of bronze featherback obtained in the treatment of the dose of the hormone thyroxin 6 mg/kg by 3% is in line with research conducted by Isvarida (2003) that the administration of the hormone thyroxin 6 mg/kg of feed can increase the growth of baung fish (*Mystus nemurus*). . However, the value of the daily weight growth rate of Bronze featherback obtained from this study was lower than the value of the daily weight growth rate of the species belida (*Chitala chitala*) which reached 4.54% reared in polyculture with tilapia for 6 months of maintenance (Samad et. al.,, 2017). The best dose of thyroxin hormone obtained in this study is also following the results of research by Sukendi *et al.,* (2013) on pearl Sepat fish where the administration of thyroxin hormone at a dose of 6 mg/kg of feed resulted in the highest daily weight growth rate value of 1.838%, compared with the administration of hormone thyroxin at a dose of 4; 2 and 0 mg/kg of feed, which only resulted in daily weight growth rates of 1.834%, 1.833%, and 1.798%. Furthermore, in motan fish, giving hormone thyroxin at a dose of 6 mg/kg of feed resulted in a specific growth rate of 0.6234% in rivers and 0.6153% in ponds, the dose of hormone

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thyroxin 4 mg/kg of feed resulted in 0.5767% in rivers, and 0.6126% in ponds, the dose of hormone thyroxin 2 mg/kg of feed resulted in 0.5583% in rivers and 0.5587% in ponds, and a dose of hormone thyroxin 0 mg/kg of feed resulted in 0.5344% in rivers and 0,5329% in ponds (Sukendi et al., 2011).

3.4. Survival Rate (SR)

The survival rate of bronze featherback reared for 90 days by feeding trash fish added with thyroxin hormone is presented in Figure 4. In Figure 4 it can be seen that the highest survival rate of bronze featherback sequentially was obtained at the treatment dose of 6 mg/kg of feed with a value of 95%, followed by treatment dose 4 mg/kg feed with a value of 90%, treatment dose 2 mg/kg of feed with a value of 90%, and treatment without the hormone thyroxin with a value of 90%. Based on the results of statistical tests using the analysis of variance (ANOVA) test, it was known that the treatment is given had no significant effect (P> 0.05) on the survival of the bronze featherback.

The highest survival rate of bronze featherback obtained in the treatment of thyroxin hormone 6 mg/kg of feed by 95% was higher than the survival value of bronze featherback reared in polyculture ponds with tilapia for 243 days, namely 47.1% (Rahmatullah, *et.al.* , 2009). belida species (*Notopterus Chitala*) reared in polyculture with tilapia have higher survival value, reaching 100% (Samad *et. al.*, 2017) and the larval survival of Chitala is 98.50% (Hossain et al. , 2006). Sukendi *et al.*, (2020) researched bronze featherback cultivation with different types of feed and stocking density, which found the highest survival rate of Bronze featherback, namely 93.33%. The linear relationship of each measured parameter is presented in Figure 5.

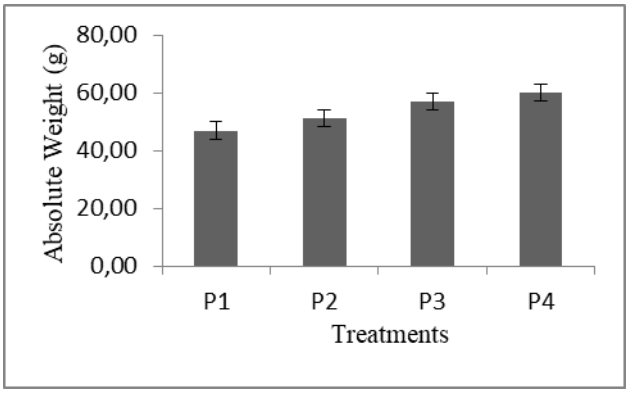

Fig.1: Growth of the absolute weight of Bronze featherback that was given the feeding treatment was added with the hormone thyroxin

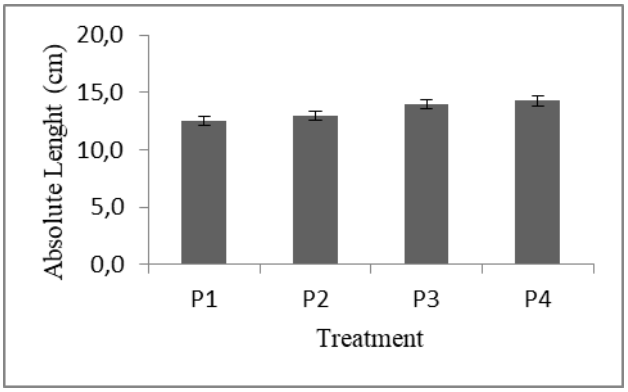

Fig.2: The absolute length growth of Bronze featherback treated with the added hormone thyroxin feed

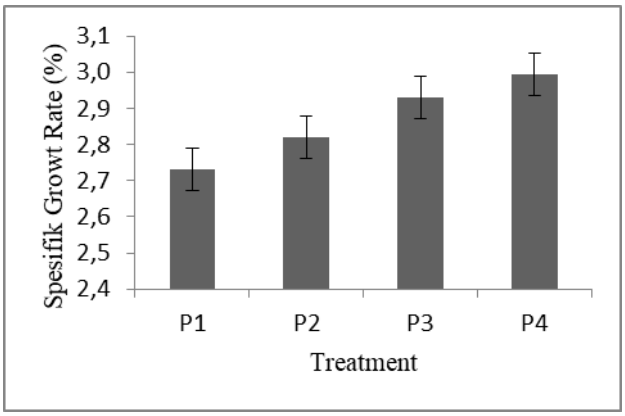

Fig.3: The growth rate of the daily weight of Bronze featherback which was given the feeding treatment was added with the hormone thyroxin

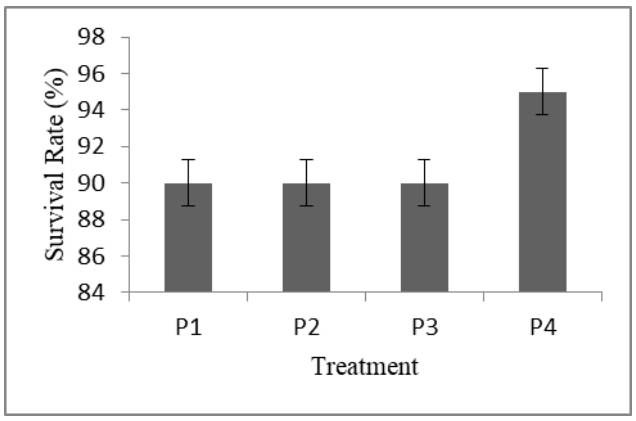

Fig.4: The life span of Bronze featherback which is given food treatment added with the hormone thyroxin

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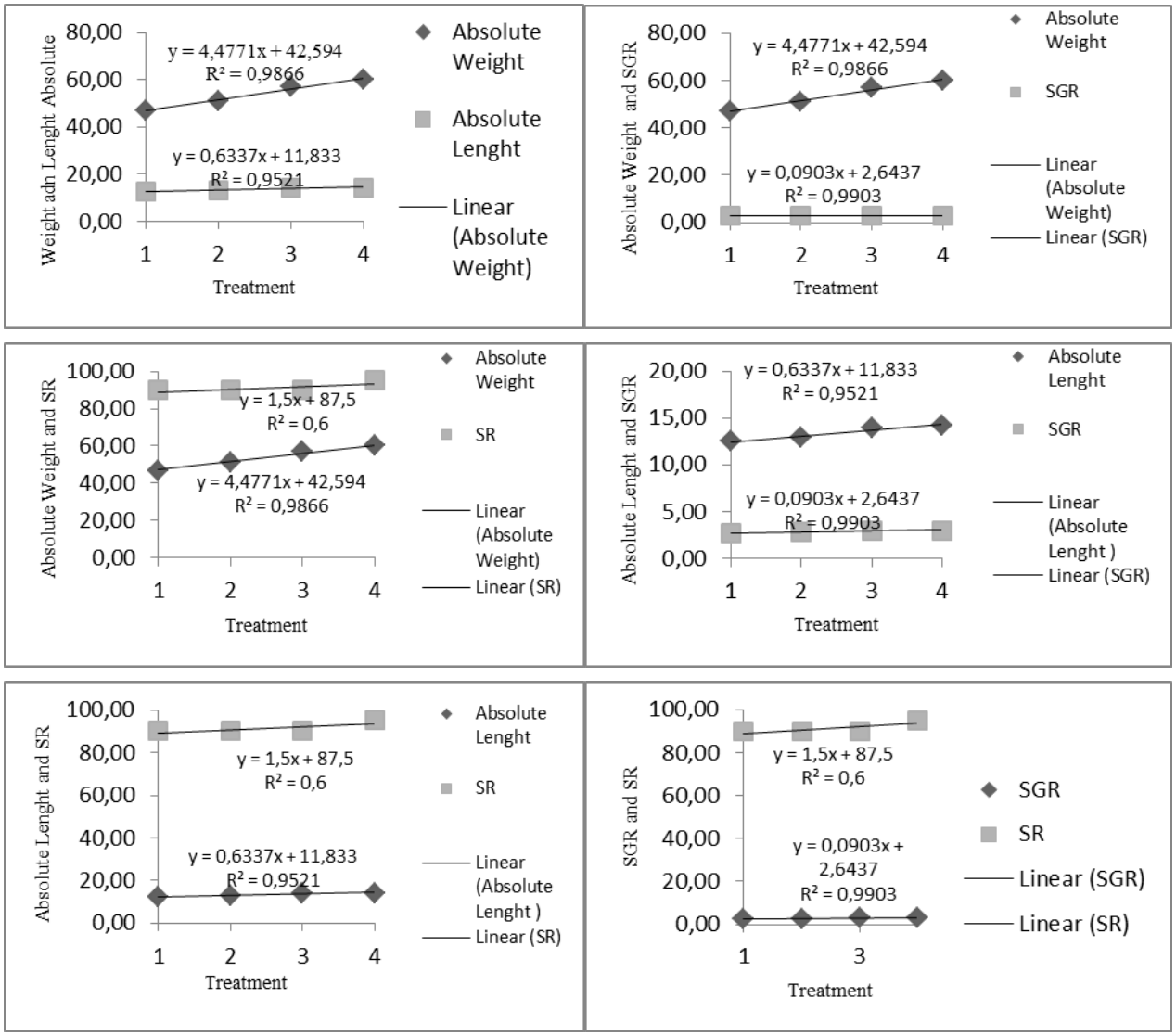

Fig.5: The linear relationship between parameters

3.5. Water quality

The results of water quality measurements for Bronze featherback rearing are presented in Table 1. Table 1 shows that the results of water quality measurements obtained during the cultivation of Bronze featherback are generally still within tolerance limits for fish farming. According to Azila (2010), the range of water quality parameters that can be tolerated by fish is a temperature ranging from 20-30 0C, a pH ranging from 4.0-9.0 and dissolved O2 ranging from 2-8 ppm and the optimum is 5-6 ppm.

Table 1. Value of water quality during the rearing of Bronze featherback

Parameter	Nilai
Tepperature	27-30^{0}C
pH	6,5-6,7
Oxygen	5-6,3 ppm

IV. CONCLUSION

From this study, it was concluded that the growth of Bronze featherback could be increased by giving the hormone thyroxin to trash fish feed. The best dose of thyroxin hormone for growth and survival of Bronze featherback is 6 mg/kg of feed and affects the growth in absolute weight of 59.96 g, absolute length growth of 14.3

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cm, the daily weight growth rate of 3%, and survival rate of 95. %.

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